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A Landscape Study on
The South-western Sector,
Kawau Island.

submitted in part fulfilment
of the requirements for
the Diploma in Landscape Architecture
at Lincoln College, University of Canterbury.

Nov. 1975

by David Lee Marchant B.A.
First, we should identify and protect the features of scenic, natural or historic importance on the coast.

Second, we should recognise that there is a limit to the quantity and type of tourism which any stretch of coast can take.

Third, we should aim at high standards of design, plus respect for local building traditions and local character.

Fourth, we should ensure that tourism development does not cause pollution, congestion and conflict at the coast.
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Kawau Island is one of 23 islands within the Hawke's Gulf Maritime Park, an expanse of ocean that is easily accessible to New Zealand's largest centre of population. Recreation demands on the Gulf show an annual increase, and perceived pressures suggest greater pressure will be directed upon a finite resource area - with increasing activity demands.

The resource administered by the Hawke's Gulf Maritime Park, the lands and survey left offers no exception to this trend.

Indeed, the uniqueness value of Kawau and its proximity to the mainland contributes to its main visitor popularity.

Such that user pressures/demands exist on South Western Kawau, but few them. Concerns of rocky resource for management of the resource are evident.

In the situation...

Objective defined...

Problems identified...

Analysis of problems reveal cause and effect relationships...that illustrate the island as a process of becoming, and its part in historical ecology, to the impact of the specious man.

Site elements are appraised are located into 2 piles...attributes and constraints, those confined the sub problems, and interconnectability of land use is investigated.

Elements are appraised...

Relating the objectives to a key site problem: Mansion House Bay development, and a concern in detail for.

Overall master plan that organizes the statements into items on the ground after having tested them as the concept level...

The user demands of the area and the design solution which satisfies them, supported true conservation detailing, and perspective viewing the development.

Policy of action...
The design study is located on the South-Western sector of Kawau Island, within the Hauraki Gulf - 13,600 sq. k.m. of ocean in the Northern half of the North Island, New Zealand.

Tawharanui peninsula, which lies approximately 2 k.m. north of Kawau, is separated from the Island by the North Channel.

The sheltered Kawau Bay is approximately 8 k.m. due west. South-western Kawau Bay continues a further 8 k.m. down the coastline to the Mahurangi Heads, a distance of 10 k.m. to the Southern coast of Kawau Island.

Immediately south, 48 k.m. lies Auckland city.

The Hauraki Gulf Maritime Parks Board, through the Lands and Survey Dept. at Auckland, administer the study area of 158 h.a. as part of the H.G.M.P. complex.

Boundaries - The coastal margins, open to the South-Channel define the site to the West and South, while the eastern boundary conforms largely to a ridge line that extends from high water mark in South cove, to a fence line running down into Schoolhouse Bay. From this point, the fence boundary (or paper boundary) reflects the acquisition opportunity of the Parks Board since its formation in 1967.

For this reason, the four promentories (as shown) are included within the study - in part to rationalise boundaries and in part to effect a geographical unit, to facilitate the study process that follows.

A relationship exists between the increased growth and affluence of the population, and the subsequent demands upon recreational facilities.

Since 1950 the increased discretionary income available to New Zealander's
study area
Kawau Island

H.G.M.P.
BOUNDARIES
has allowed a "choice margin" of spending beyond their need for basic necessity items.

Therefore, a wider range of possibilities in recreation is available to a larger proportion of the population (through increased leisure and mobility) - the demands made upon the Hauraki Gulf region offers no exception to this trend. Thus, the capability of the study area to absorb use, and the demands made upon its finite area is (in part) dependent upon:

- the user numbers
- the user types/classes
- proximity to the use
- design solutions to accommodate the above

these then, are the cultural factors facing the Island.

In addition, the cultural pressures on the Island have their impact upon the natural systems. If change (as a response to man) is in accord with the natural systems existing on the site, then it is changing with the environment.

Historically, however, man's presence on Kawau has paid little heed to the ecological processes. Over much of southern Kawau introduced vegetation is dominant. In some areas, the suppression of natural climax species has led to severe erosion and depletion of wildlife.

The introduction of browsing mammals has contributed to the rapid change in appearance of Kawau since the impact of man.

The study objectives, therefore, are two-fold:

1. to satisfy the user requirements of the study area and manage the site's capability to absorb use.

2. to direct any change in accord and in sympathy with the natural systems existing in the study area.

To commence a landscape study on South-Western Kawau involving a set of plans, together with a supporting written report showing:
1. proposals for the management of the area involving site circulation, zoning of appropriate and compatible areas, and the protection of ecologically sensitive areas.

2. a detailed concern for Mansion House Bay, involving design proposals for its re-development.
Evidence exists of intensive Maori activity around the coastline of the Islands within the Hauraki Gulf, and is considered to have had a major impact on the present ecology.

The four major migratory causes, Tainue, Arana, Matatua and Motua contributed to the peopling of the Auckland area after 1350 A.D. In more recent years the Ngato-Paoa tribe dominated the Hauraki Gulf with the Ngati-Whatua occupying much of the isthmus area.

On Kawau Island, the Maori occupied the fortified headlands, that are a feature of the Island. From these and the inland villages, passing tribes were attacked and marauded.

Skirmishes with the Nga Puhi chief Hongi Heke resulted in a decrease in the Maori population, to the extent that when D'Urville visited the Waitemata in 1872 he reported it to be deserted.

Interest in the Island during the early part of the 19th century was prompted through the discovery of manganese and copper deposits. This discovery was related back to England by the crews of the trading schooners that sailed up the Matakania Harbour.

In 1842 miners had arrived on the Island, and until 1862 some 400 miners worked at the mines dotted over the Island. During this time the mine manager constructed his home in what is now known as Mansion House Bay.

The most productive mine at Coppermine point produced some $120,000 worth of copper from 1846-50; the most profitable in New Zealand. From 1846-67 nearly 25,000 tons were won from the mine. Further mining produced little more, and after later investigations the mine was finally considered exhausted in 1862.
Sir George Grey (the then Governor General of New Zealand) purchased Kawau in 1862, taking residence in the mine managers house where he made considerable change and renovation to create Mansion House. Kauri logs from the Kawau stands were sent to England to be turned and polished for the library pillars.

Sir George Grey set about constructing his Victorian paradise in the South Pacific, and initiated the first major change to the Island's unique ecosystem with liberation of Emus, Wallabies, deer, and even a pair of Zebra's. In addition, Sir George enthusiastically collected plants from all over the world - his garden in Mansion House supported nineteen gardeners.

A selection from Sir George Grey's letters (courtesy Auckland Public Library) in Appendix 1 illustrates his detailed planting programmes to forest the Bay in Pine, and reflects his interest in the collection of many different horticultural specimens.

Until 1877, Sir George was active in the political life of the colony, residing on Kawau when the opportunity presented itself. Between 1877-1888 he was able to spend most of his time in Mansion House Bay grooming his paradise to the delight of the many distinguished guests that were offered a variety of recreational pursuits; boating, shooting, fishing, riding, and coastal and scenic walks.

Thus, by 1888, Mansion House Bay and its extensions were consciously designed to cater for the recreating visitor. The resources available to him were essentially the same as that offered today. The theme was set for further development.

Ailing health and a desire to return to England prompted Sir George to sell the Island in 1888. Several owners followed Sir George, and the early years of the 20th century saw the beginning of subdivision on the Island, with the "development peak" being the recent acquisition of approximately 2,000 ha. on Southern Kawau by a private development company. With the intermittent management of Mansion House as a guest house since 1910, the regency and order of Greys gardens have fallen into a steady state of decline.
South Western Kawau has become a mecca for the yachting public, a port of call for the excursion steamers, and an anchorage for the R.N.Z.N. during weekend exercises.

In 1967, Mansion House and its surrounding property (34.8 h.a.) was sold to the Government for inclusion in the Hauraki Gulf Maritime Park. Since this time, an additional 130 h.a. was purchased, to total 164 h.a. (361 acres) of parkland.

Today, Mansion House is managed as a licensed Hotel; one of five accommodation units that dominate the Bay.
The photos opposite display Mansion House of yesteryear.

The house was built in 3 stages: the right wing in 1840, with the rest built in 1865 following the purchase of the house by Sir George Grey.

The 2 tiered verandahs were added 20 years later.

Note the timber palisade fence in the foreground which recalls the rhythm of the verandah.
This Chapter deals with:

1. the aims and background of the Hauraki Gulf Maritime Park
2. With the existing users of the park, and their projected needs.

The H.G.M.P. Act was passed in 1967, partly as a response to projected population demands and their associated uses. The Act was initiated to protect the offshore islands situated within the Hauraki Gulf.

The Hon. D. MacIntyre, Minister of Lands in 1967 said this of the Parks.

"The creation of a Maritime Park ... ensures the conservation and protection of areas containing outstanding natural features of geological interest as well as the preservation of native bird and plant life".

The Hauraki Gulf covers 13,600 sq. k.m. of ocean with a total land area of 8,514 h.a.

The Gulf itself is a large, relatively shallow bay, extending from the fertile tidal mudflats of the Pirth of Thames and sheltered Auckland harbours, out to the exposed outer islands. The western and southern coastline of the Gulf is deeply indented with bays and harbours, and the sea-floor shelves out to a depth of 20 metres. On the north-eastern side the sea-floor drops steeply down to 40 metres. The outer Gulf area is mostly between 40 metres and 100 metres deep. Bottom sediments range from fine mud in the shallow water to sandy mud at 100 metres depth, with areas of fine sand in Colville Channel and off the beaches north of Jellicoe Channel.

Winds are variable in the Gulf area, most frequent from the west or southwest, but most of the strongest winds are from the north-east. From recordings on the mainland, rainfall is between 1040-1500 mm and is greatest in May - August, least in December - March.
Sunshine per year is between 2000 and 2200 hours. Monthly mean air temperatures range from about 19°C in January - February to about 11°C in July - August. Conditions over the sea will differ in various ways - the air temperature will be less variable, cloud cover and rainfall less, and wind speed usually greater.

The main ocean current of the region is the East Auckland current, which is part of a large body of subtropical water deflected by the Northland peninsula. It produces net movement of water south-eastwards across the entrance of the Gulf. The flooding tidal stream sets northwards along the north-eastern coast of New Zealand, and turns southward into the Hauraki Gulf. At spring tide currents reach a speed of 2 to 3 knots in Colville Channel, one of the main tidal entrances. Inside the Gulf the flood tide sets south and the ebb tide generally north. A survey in 1965-66 found that surface and bottom temperatures ranged from 22°C and 20.5°C respectively in March to 12.5°C and 13°C in July - September.

During the last glacial period the Islands in the Gulf were connected to the mainland, exhibiting a wide variety of rock types. The oldest rocks inside comprise largely unfossiliferous dark coloured sandstones and mudstones (greywacke and argillites). Less common are the spillite - a layer of lava and jasper.

This trough of sediments and rarer lava was deformed and uplifted above sea level and subjected to erosion over 135 million years ago - as evidenced along the indented shores of Kawau Island.

During the miocene (65 million years ago) the sea re-invaded the Park region depositing unfossiliferous sandstones and siltstones (Waitemata Sand Stones.)

While the inner Islands have been largely man modified, the outer Islands remain the largest area in New Zealand of temperate coastal and lowland vegetation with indigenous wildlife that has not undergone major modification by man. They offer unique conditions for scientific study - in a sense, a living laboratory in natural experimental conditions. In general, the life on the Islands is quite undifferentiated, both at the species level and that of the communities and ecological systems. The insular nature of the flora and fauna produce a simplified but more fragile ecosystem.
Atkinson (1) notes that scientific investigation of the Islands covers a period of more than 100 years, beginning with visits and descriptions by T. Kirk, F.W. Hutton, T.F. Cheeseman, A. Reishet, and others in the 19th century.

Further, he considers that the terrestrial and marine exosystems of the outer Islands are of inestimable value for monitoring environmental changes and for comparison with mainland reserves.

To a large degree, the inner Islands, such as Kawau, are no exception to this.

Atkinson stresses the need to protect and manage the Island resources, in particular the outer Islands (less than 0.02% of the land area in New Zealand) as reserves of coastal and lowland biota and communities.

The Gulf provides three major habitats:

1. shoreline
2. coastal waters
3. open sea

which supports both pelagic and demersal fish.

The estuaries in the area provide ideal nursery and feeding grounds for many species of fish while the shoreline tidal rock pools and deeper weed beds afford protection for the many species of periwinkle and molluscs, etc. which inhabit the area. In addition, at low tide, a feeding ground is exposed for the sea birds.

Atkinson notes again (1) that each Island has its individuality but considers that a classification system is necessary for long term planning and protection. He proposes a simple three category system:

Class A - Islands where scientific and wild life values should be considered paramount - landing by permit only.

Class B - Islands where both scientific and recreational values should be considered of comparable importance - unrestricted landing.
Class C - Islands where recreational values should be considered paramount - unrestricted landing.

Kawau Island is placed between B and C under Atkinson's classification - it offers recreational, historical and scientific resources.

The H.G.M.P. is situated at the "back door" of the largest and most rapidly growing city in New Zealand. The 1971 census showed a population of 698,400 for the central Auckland area, an increase of 13,8 on 1966 census. In comparison, the population of New Zealand as a whole has shown an average annual percentage increase of only 2.7% over the last 10 years. (2).

It is predicted that by the year 2001 New Zealand is expected to have a population of 4 million plus: as against 2.86 million in 1971.

An Auckland Regional Authority study, (2) investigating the growth patterns in Auckland found that especially in Auckland there has been a continuing growth in the population of those under 25. In the metropolitan area this group comprised 47% of the total population in 1966, compared with 36% in 1945. They consider this age bracket to be the most active in terms of involvement, and the marked growth in its numbers inevitably would lead to greater pressure on existing recreational programmes and facilities.

Perhaps more relevant to recreational pursuits in a maritime park are those activities which are water based. Recreation patterns in Auckland, ARA 1971 (Appendix 2) clearly show the present and future trends, in active water based sports as being of high participation when compared to other active and passive related activities. Similarly, a survey of boating patterns carried out by the ARA 1970, show that in terms of participation pleasure boating is the most popular of outdoor recreation. It was estimated that 100,000 people participate regularly in boating in the Auckland metropolitan area, and that there existed an increase of 1200 - 2000 pleasure craft annually.
It is this single factor, coupled with proximity to the recreating area that exerts an overwhelming influence on the user pressure demands within the inner islands of the Hauraki Gulf.

The ARA further indicates that boatowners have a rather narrow activity preference (1970 Survey); that the most use of pleasure craft was given to the following:

<table>
<thead>
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<th>Activity</th>
<th>Percentage of all activities given</th>
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<tr>
<td>Fishing</td>
<td>37</td>
</tr>
<tr>
<td>Fishing and pleasure cruising</td>
<td>18</td>
</tr>
<tr>
<td>Racing</td>
<td>29</td>
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<tr>
<td>Racing and pleasure cruising</td>
<td>8</td>
</tr>
<tr>
<td>Water Skiing</td>
<td>2</td>
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<tr>
<td>Water Skiing and fishing</td>
<td>3</td>
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<tr>
<td>Other activities</td>
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It is also noted that with increasing distance into the Gulf the intensity of boating diminishes - as continued by the Park Board's own Survey (1973).

With regard to the more passive land based recreating activities such as picnicking, camping, nature study, skin diving, sightseeing, etc; accurate figures are almost impossible to obtain due to the "openness" and unrestricted access to the Maritime Park area. The only source available is from the public ferry services that provide regular transportation to Waiheke Island, Gt. Barrier Island, Rangitoto Island Motuihe Island and Kawau Island.

As would be expected, in the light of the previous discussion, the visitor numbers show an annual increment.

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<th>'70</th>
<th>'71</th>
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<td>235598</td>
<td>21271</td>
<td>22258</td>
<td>25272</td>
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<tr>
<td>Motuihe</td>
<td>21501</td>
<td>22351</td>
<td>15166</td>
<td>23009</td>
<td>25000</td>
</tr>
<tr>
<td>Kawau</td>
<td>12957</td>
<td>15512</td>
<td>17230</td>
<td>21982</td>
<td>20161</td>
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Within its Regional setting the planning division of the Auckland Regional Authority (3) investigated coastal pressures and trends, and relates these to the coastal resource capability. Appendix III.

Among their findings:

- Given a continuation of present urban growth patterns and trends, a further 15% of the region's coastline could be substantially developed by the end of the century.

- The great bulk of holiday and recreation activity in the region's coastal area must be accommodated on 85 kms of beaches along the north-east and south east seabords, representing less than 6% of the total coastline.

- The development that has taken place recently on the north-eastern seaboard has the inherent problem of imposing visually unsuitable suburban development upon areas of high scenic quality.
The Regional situation of Kawau Island and in particular the study area, within a Maritime Park, adjacent to New Zealand's largest centre of population, imposes growing recreational pressure upon a finite resource area. The conflict remains between the desire to use, and the need to protect the resource.

It appears that to realise the Park Board's main objectives in regard to individual areas as part of a total park system, statements of policy must ensue to guide management decisions.

The data covered in this Chapter is an attempt to provide a predictive tool that in some way is able to see some future trends - as against clairvoyant non-data planning.
Within this Chapter there are three areas of discussion:

1. Significance of location.
2. Physical attributes.
3. Cultural attributes.

Island access - three times daily in the summer months a ferry departs from the sandspit near Wakworth for Kawau Island. Depending upon the passenger demand, it calls at any of the private jetties from North Cove to Bon Accord Harbour. In addition, a ferry runs Auckland City to Mansion House Bay in peak holiday times.

The Island is also serviced by an amphibian aircraft company that offers a service on call. The enclosed and sheltered waters of Bon Accord Harbour and around North Cove afford safe landing conditions, protected from the open sea swells that run between Kawau Island and Tiri Island.

Further access to Kawau is gained only through private boat owners, where safe anchorages are found in both Bon Accord Harbour and in North Cove.

The following factors are those that bear major influence on Kawau Island, both at present and in the future:

(a) Kawau's situation in the Hauraki Gulf, as part of a total system within a maritime park setting, offering a wide variety of recreational opportunity, encouraged by an equitable climate and sheltered waters.

(b) Proximity to Taketu point - recently acquired by the Auckland Regional Authority (A.R.A.) as a recreational reserve - only 1½ k.m. from Kawau's Northern most point.

(c) Proximity to the eastern shores near Wakworth, where the Growth Alternatives Study (1975) (2) shows that in 25 years Auckland's growth may
necessitate intensive urbanisation in Waiwere, only 20 k.m. from Wakworth.

(d) Land ownership of 2,000 h.a. plus of Southern Kawau by a private development Company that surrounds the H.G.M.P. land on the landward sides. Their aims are to subdivide where possible, and to provide "reserves" on land, unsuitable for building.

(2) Physical Attributes

A moderate rainfall is spread through the year, but generally more rain is experienced in winter. Kawau experiences warm but not excessive summers, and mild winters - an important local asset, for it is 20-30°C warmer than the mainland. Frosts are rare and seldom have they been known to occur greater than 2°C.

Diurnal temperature is small - 6°C is consistent throughout the year. Humidity is also relatively consistent with little variation from the mean. Winds conform to the pattern through the Gulf as previously discussed.

See Appendix 4 for tabulated data.

Kawau is an Island of low relief with steep cliffs facing the open sea, and inlets formed by drowned valleys on the landward side. The highest point, Mt. Taylor is 452.4 m.a.m.s.l.

A number of small steeply clifed islets lie inshore. Intertidal flats and swamplands fill the Bayheads. The main water catchment area is almost at the top of the Eastern cliffs.

Along the Eastern shoreline, tidal rock pools and rock shelves which lie between the inlets are exposed at low tide.

South of Dispute Cove, large rocks begin to dominate the shoreline and are associated with the more rugged topography at the cliff edge that is encountered at the Southern end of the Island and the Eastern shores.
More than 250 metres of arenite and siltite, including chert and spilitic lava form the basement rocks, comprising the Waipapa group. The Waipapa rocks were eroded in Miocene times to produce a rugged topography - including the sea stacks and cliffs with rubble slides.

The Waiate group overlies the Waipapa, consisting of depositions of eroded Waipapa and interbedded sandstone, siltstone and fine basal Conglomerate, - the greywacke and angillite deposits. This group, of unconforming surface is found along the North eastern coast and the South east coast, and on some of the inshore islands. They are now of shallow dips and outcrops.

The sea levels of the Quateriary age produced the streams which are now occurring as Harbours. Alluvium from the weathering of older rocks, organic debris and marine silt is found on the Bayheads and on valley floors forming the Quateriary deposits.

(The latest high sea transgression was the Flandrian, which produced terraces and deposits about 2 metres a.s.l.)

Distribution - there are two main geological sequences. The more westerly is one of well preserved bedding with a lack of sandstone, but where Argillite exceeds 50-60% disruption of the bedding occurs.

Over much of the remaining Island area is found well disrupted bedding. Here, argillite percentages are commonly 50% and over. The sandstones reacted by folding and lasing, while the argillites by plastic flow with oblique shearing and faulting accompanying the process.

The Economic geology is discussed in the course of this report with reference to the study area.

There are three sources of supply available on Kawau:

(i) roof tank
(ii) natural catchment areas in the gulleys
(iii) drill holes, where the underground streams are tapped. A supply source is not provided from the mainland.
In contrast, power is fed to Mansion House Bay through an underground cable, and reticulated to School House Bay by overhead wiring. The result is a distinct urban flavour, where reticulation is coupled with residential land use.

100 years ago, Kawau Island was covered by a carpet of rich native flora, (see notes on vegetation for study area), but the impact of man has had some dramatic consequences on the natural systems of the Island. The intermittent burning to clear land for grazing, and the browsing damage from the liberation of wallabies, and to a lesser extent the oppossums, has contributed to a complete suppression of native species in many inland areas. Esler (5) considers that only two tree ferns; the black ( _Cyathea medularis_ ) and silver ( _Cyathea dealbata_ ) two trees, (Manuka and Kanuka) and two grasses (Danthonia and Micro-Laena) are holding their own. Except for the South western area of Kawau (largely covered in pine), the dominant cover today is reverted scrubland and some grass lands.

Native vegetated areas that have resisted the domination of exotics remain (1) the coastal fringes; generally with Metrosideros excelsa (Pohutukawa) clinging to the often steep cliff faces, some _Cordyline Australis_ (Cabbage tree) commonly with an understory of _Phormium tenax_ (flax) and _Pseudopanax lessonii_ (Lonpara).

(2) Those wetland areas, on the sides of the many watercourses, that prove unsuitable for the encroachment of the Pine. These areas support an abundance of fern and tree fern.

Wallabies, which were thought to have been liberated between 1856-70 were listed as "noxious animals" in New Zealand, under the Noxious Animals Act (1956). Extermination programmes were carried out on Kawau Island until 1968, when the H.G.M.P. declared, them a protected animal within the Park boundaries. Their recovery has been rampant in the ensuing seven years, such that their modifying effect of their sorting the vegetation has been severe.

D.L. Kinloch (6) (the Ecology of the Farma wallaby) notes 5 species present on Kawau:

4,6 VEGETATION

4,7 ECOLOGY
This vegetative pattern of Pine scattered amongst manuka is typical of that outside the study area.
- Macropus parma (white throated wallaby)
- " eugenii (silver grey)
- " dorsalis (black striped)
- Wallabia bicolar (black tailed)
- Petrogale penicillata (bush tailed)

Of particular interest is the Parma wallaby. This marsupial was thought to be almost extinct in its native habitat of Australia, with the result that several Kawau specimens have been reintroduced there, ensuring its national survival.

A summary of the wallabies distribution is given opposite.

Along its distinctive coastline and contrasting shoreline, Kawau offers a variety of coastal experiences. The contained Islets and Bays of western Kawau with the mainland only 10 k.m. away, contrast vividly with the open sea views and exposed rocky coastline of eastern Kawau.

Further inland land form, geological features, and patterns of vegetation contribute to demark the Island into distinct zones of visual identity.

Historically, Kawau's association with copper and manganese extraction in the 1840's, and the following years administered by Sir George Grey lend to the Island a "national uniqueness" (as discussed in Chapter 1).

The map, on the following page, shows the land ownership patterns on Kawau Island. They are not specific and display only general boundaries. It may be seen that residential land use conforms to the sheltered waters and protected bays and inlets. Some 50 odd jetties are dotted around the Island.
Kawau Island is situated within the Rodney County which administers an area of approximately 2372 km². In area, the county occupies more than half of the Auckland region, but its population comprises only about 3% of the regional total.

The following statement of objectives and policies is extracted from the District Planning Scheme Review for Rodney County. The County includes within their general objectives to "Conserve those features of the environment which enhance the amenities of the locality".

They further aim to "Classify the coastline with regard to scenic merit and ensuring the preservation of those areas of highest scenic quality." And: "the active encouragement of the preservation of places and buildings of historic or architectural merit."
A detailed policy for Kawau Island Appendix (6) displays the County's recognition of the potential of Kawau to satisfy changing recreational needs and also points out that particular attention must be given to the formulation of restraints in the protection of the resource(s).

Kawau Island is presented as a myriad of layers, a visible process of geological and biological change over time - from the Miocene period (50 million years ago) to the present.

In this vast time span, it is only in the last 150 years that we see an accelerated change to the biological layer, due to the presence of man - the "Cultural" layer.

Nan Fairbrother in "New Lives and Landscapes" (?) suggests that landscape is the habitat manipulated by man for his own uses - it is the interaction of a society and the habitat it lives in, and if either man or habitat changes, then so inevitably must the resulting landscape.

So, the landscape is the changing face of our planet.

Today the landscape patterns on Kawau are determined wholly through the Cultural layer. The locational significance of Kawau is to further effect user demands upon the existing landscape patterns.

The following chapter deals with the study area in detail, as affected by its local, and regional context.
the study area 1953
McHarg, (8), an ecological planner, considers that any place is the sum of historical, physical and biological processes, that these are dynamic, that these constitute social values, that each area has an intrinsic suitability for certain land uses, and finally that certain areas lend themselves to multiple co-existing land uses.

An "Ecosystem Inventory" is the term McHarg uses to describe the natural formative features which attempts to identify them, as the products of climate, historical geology, physiography, hydrology, pedology, plant associations animals and land use.

It is important to deal with data collection in the above sequence, for it reveals the concept of causality ...... and thus the historical reasons for the identity of an area.

Simply stated, the process becomes visible.

An investigation of the study area is approached as follows:

1. Inventory of the resources, or: Eco-Inventory - to investigate the historical determinants upon the study area.

2. An appraisal of the resource potential and problems, and the formulation of environmental constraints.

General climatic factors are no different from those discussed in the previous chapter, under the Island influence.

The bays in Bon Accord Harbour are afforded protection from the southerlys, and the north-easterlys that frequent the Hauraki Gulf, while the western
Looking up Bon Accord Harbour.

The study area lies beyond the promontory in the middle ground, with the mainland just visible in the distance.
coastal boundary of the study area is more open and, therefore susceptible to air masses travelling down the south channel.

A rain gauge has been stationed on Kawau Island since 1968, although there are many breaks in the series due to changing of stations. See Appendix (4b). Consequently figures available from Leigh situated nearby are perhaps more representative.

Depositions of Waipapa, Waitemata and Quaternary material are found on the site area layered in sequences as previously discussed. Deeply weathered Waitemata and Waipapa on steep slopes are prone to slump and creep - areas particularly susceptible to this are shown on the "sieve map".

Similarly, the coastal margins are very sensitive to erosive processes where vegetative cover is sparse and/or shallow rooting. Four factors are critical here -

1. base material
2. angle of slope
3. soil cover
4. vegetative cover.

In Bon Accord Harbour, banks of sand or terrace like deposits, with gentle seaward sloping surfaces formed during the Flandrian transgression, form the drowned valley - which now appears as the harbour. Pleistocene shell deposits found above high water mark remain as evidence to high interglacial sea levels.

Disseminated copper of 1.04% was reported by Cox (1882) on diorite north-east of Bon Accord Harbour, and this, in the light of modern extraction methods may lead to renewed mining interest on the Island (9).

An existing monument to the mining of minerals from Kawau Island is the old copper mine structure, situated on the south-western coast.

After 125 years, only the tall chimney and some of the Eastern wall remain as an icon to its colourful past.
study area
Kawau Island
This photograph displays the deposition of soft, weathered Waitemata sandstone at Ladys Bay - yellow ochre in colour flanked by sparse clumps of pohutukawa.
The tall chimney of the old coppermine structure remains as an icon to the mineral extraction of last century.
The main part of the structure is constructed of large rough hewn sandstone blocks cemented together with what appears to be mortar made from burnt shells. The chimney is bricked. The Kauri lintels over window and door openings have decayed, allowing the masonry to tilt and crack. It is thought (10) that the more the tilting occurs, the heavier the loading on the decayed lintels, and the more rapid the complete collapse.

Associated with the old copper mine buildings is an open shaft, displaying around its opening the green seams of copper deposits.

The accompanying drawings display the workings of the shaft and the depth of penetration into the parent material.

The old copper mine structure and the shafts are within half an hours walk from Mansion House Bay and prove popular as a destination point.

Both historically, and from a public safety standpoint, it is desirable that their structure be attended to, and preserved.

In 1967 it was estimated (10) that the replacement of lintels and general closing of cracks by concrete with some tying together would amount to $4,000. In addition, it was recommended that in the interest of public safety it was best to close the shaft opening altogether. An appropriate plaque would ensure recognition to its working past.

There are three topographical units to the site:

1. coastal topography
2. undulating topography 25ft - 150,250 ft, (7.6m - 75.8m)
3. rapidly rising steeplands, to 350ft (106m).

These units may be further defined as consisting of physiographic features, i.e.: features possessing a physical uniqueness. Vis., - (a) Southern boundary of the site, with shallow rocky shores and enclosed sandy bays that are revealed at low tide. (b) The bays and promentorys of Bon Accord Harbour, shallow and gently dipping.
LANDFORM CROSS SECTIONS

**Note:** Vertical scale doubled.
The landform cross sections (as shown) connect the ridge tops, and display the moulding of the land under the north-west, south-east striking megascopic anticlines and synclines during the Permian to Jarossic age. It is noted that the overlying Waitemata formation results in the undulating surface, with the bedded Waitemata sequence (sandstones, siltstones, greywacke and argillite) deposited on the coastal margins.

The Analysis of slope (derived from the ratio of contour interval and distance between contour lines) reveals those critical areas in relation to drainage and erosion.

Cliff Tandy, in a discussion on the behaviour of slopes sees that the resistance of fragmented material to move, is due to its cohesion and friction. Friction is reduced by the weight of overlying material and is, therefore, related to the angle of slope. Cohesion is reduced by an increase in water content, and in cohesive soils friction and the cohesive colloids save to stabilize the slope.

The interaction of these two conditions may result in slope failure - generally at angles greater than 20\%.

The study area, slope failure is checked by the mantle of vegetation. Where the rooting depth is insufficient on the steep slopes, land slides and slump and creep action occurs. This is common where Pine have colonised steep-land areas, particularly around the coastal margins.

The overland flow of water is determined by (1) topography, (2) precipitation rate, modifyable by the rate of infiltration and percolation through the soil bodies.

Two drainage systems are evident:

1. Through established drainage channels and small collection ponds situated in small scale gulleys between the ridges.

2. Direct drainage into the sea from the cliff tops.
In the winter months, (April - August) high precipitation of 107-145 m.m. results in ground saturation in the low lying areas, limiting circulation ease around the site. Open drain systems are necessary to direct the water into established channels where site usage is of high demand.

The diagram opposite (not to scale) suggests the structure in Waitemata rocks between Copper Mine Point and Ladys Bay.

Observed pollution of organic and inorganic material exists in Mansion House Bay and Two House Bay - a consequence of litter, bottles, cans, etc. dropped 'over the side' by those who have sought temporary mooring. An examination of the floor of the bays through a diving inspection reveals a carpet of debris in the sub-littoral zone (from the lower shore and beyond). Spillage and leakage of petroleum products contribute to the poor quality of water in this area.

It is noted in a survey of yacht basins and marinas made in February 1973 in the Waitemata Harbour, that the dissolved oxygen level is already seriously depleted at some stages of the tide such that biological deterioration is encouraged.

It is difficult to project the state of the biosphere of Mansion House Bay, and indeed other Islet areas because no scientific study of this type exists for the area, although water quality standards have been forwarded under Section 26(c) of the Water and Soil Conservation Act (1967), in schedule 6. Water surrounding the study area has been classified as SB (see Appendix 7.)

Pollution controls seem necessary to ensure preservation of unique biological resources.

There are four zonal soils represented in the study area.

1. Whananaki gravelly sandy loam (WHiG) - young to immature yellow-brown carths (YBB's)
2. Marua clay loam (MR) - moderately leached (Y.B.E.'3)
3. Marua Hill soils, clay loam (MR) moderately leached (Y.B.E.'s)

4. Rangiora Clay - clay loam, and silty clay loam (RA) - weakly podzolised.

Whananaki Gravelly Sandy Loam: -

This soil type is found on the Bay floors, and reflects the time when the Bay would have been flooded during high interglacial sea levels. Plenstocene shell deposits are found above high water mark. The soil is moderately leached and suffers from impeded drainage conditions in low lying areas. Natural fertility is medium, with the humus top soil shallow in places.

Marua Clay Loam: -

Parent Material: Greywacke that has been deeply pre-red-weathered under a former warmer climate. Depth of weathering ranges in depth from 60 to 90 ft to the hard core greywacke rock. This pre-red-weathered material shows the former shattered imprint of the rock with coatings of manganese between the old shattered faces. This material is now soft and brittle of a clay like texture.

Elevation: This is varied it may be the rolling lands at the foot of the hill soils or the rolling lands of the uplands, 100 - 200 ft; 300 - 400 ft or 500 - 800 ft.

Relief: Mostly rolling lands frequently with short strongly rolling slopes to the stream patterns, but fewer areas of easy rolling slopes.

Soil Profile:

The average depth of the soil profile to the pre-red-weathered parent material is varied, from 3 - 4 ft. It is common to observe prismatic like structures, a result of shrinkage during the more prolonged dry conditions. The more defined prismatic structures are due to the imprint of podocarp or Kauri within the former broadleaf forests.

This soil is moderately leached in the upper horizons and more strongly leached with increasing depth in the lower horizons. The main reason, has been the competition involving time, between the influence of native
broadleaf forest in its struggle in returning plant food to the soil and the leaching action of rain-water.

**Drainage:**
A moderately well drained soil, with slower permeability in the second B horizon.

**Natural Fertility:**
A moderately leached soil with medium natural fertility but low to very low in the lower horizons.

**Soil Conditions:**
The humus topsoil is somewhat shallow in places and a dark greyish brown; when moist it is a friable and mellow fine structured clay loam of good porosity. The subsurface (A2) shallow horizon, is also friable and mellow and fine structured but more inclined to fret to a single grain structure.

When dry the soil aggregates become hard to very hard and due to shrinkage they are of poorer porosity and are slow to-re-wet. In the B horizon the finer aggregates are inclined to bind together when drying out and become coarse hard structures of poor porosity.

The most favourable condition for cultivation of this soil is when moist to moderately moist and the soil temperatures warm. It is then that the soil can be cultivated without destroying the structures of the soil, not when dry or wet.

**Marna Hill Soils:**
Similar to the Marna clay loam, although this soil contains some variations due to the hill location.

**Relief:** moderately steep, short slopes.

**Elevation:** 200-400 ft approximately

**Profile:** the average depth of the weathered parent material is 2-3 ft, with a strongly developed prismatic structure breaking down to a coarse blocky
structure.

Erosion: slight to moderate sheet erosion, with a few small areas of severe sheet erosion.

Moisture Holding Capacity:
Good. Would expect a good even level of moisture during wet or evenly dispersed rainy periods. After long dry spell the soil aggregates become very hard, a hard crust forms on the surface, and the soils are very slow to re-wet. There is a rapid runoff under these conditions, because of the low infiltration.

Rangiora Silty Clay:
Parent Material: Greywacke, strongly and deeply weathered.

Relief: Rolling land, angle of slope 10° - 12°.

Elevation: Approximately 100 - 200 feet.

Rainfall: Approximately 40 - 50 inches per annum.

Drainage: Imperfectly or somewhat poorly drained the subsoil (4" - 16") restricts through drainage.

Natural Fertility: strongly leached.

Moisture Holding Capacity:
Good to somewhat excessive. During the winter or rainy periods the subsoil holds much moisture retentively for fairly considerable periods. After long dry spells the subsoil is slow to re-wet.

Mana Clay Loam:
The native forest on the rolling lands was dominantly broadleaf, with some podocarp and the occasional kauri, interspersed with Tairaire, Puriri, Karaka, Rewarewa, Kohekohe, Nikau and pongas.

The soil profile expresses evidence of the losing battle of the forest
influence, against the leaching action of rain water.

Marja Hill Soil
The hill soils supported a mixed forest with a strong kauri mosaic, mainly on the ridges. The broadleaf is dominant in the gulleys and lower slopes. Interspersed species were: Tairaine, Kokekohe, Puriri, Karaka, Rewarewa, Tawa, Ponga, Nikau, Rimu and Totara.

Man Modified:
Of the total land area involved in this study, approximately 65% is covered in Pine. The most numerous species is Pinus Radiata, with more locally defined groups of P. pimaster, interspersed with the occasional Cupressus Maorocarpa.

On most of the rocky coastal areas and around Mansion House Bay and School House Bay the trees are widely spaced at a variety of stem densities. In the gulleys they are supported by a vigorous growth of ferns with Manuka and Kanuka growing towards the ridges.

It is noted that the leached yellow-brown earths are generally prone to drainage difficulties and when contoured with slopes greater than 30% plus the shallow rooting of the Pines; slips and erosion are frequent. The result is a depletion of vegetative cover below the slip, and therefore an unprotected land-slope.

Establishment of root clinging Pohutukawa controls these erosive processes.

Away from the coastal fringes of the Island, on the clay ridges between Mansion House Bay and School House Bay, and further along the main ridge of the peninsula, P. Radiata of high average stocking persist - with many trees between 40 and 50 years old.

The opening of tracks has allowed, in some cases, colonisation of the track sides by Kanuka/Manuka (pre-climax species of the native forest cover).
A contrast of form and texture - cliff hugging pohutukawa on the left; stout, branching and spreading .... and tall linear pine on the right, with the characteristic litter of pine needles on the forest floor ....
There is a distinct pattern to the distribution of these species, governed by:

1. Natural drainage paths/topography.
2. Culturally induced competing species, and grazing and browsing damage.

The wetter areas of the drainage channels generally support tree fern, and in cases, puriri, punga flax, and cabbage tree. Where drier conditions are encountered up the slopes, the Pines are dominant. Tree ferns thrive as understory planting where gaps in the Pine forest canopy exist.

Only those species unpalatable to the wallaby and bush tailed oppossum are found in the study area. These include Manuka, Kanuka, tree fern, flax, cabbage tree, the broadleaf species one may typically find on this forest floor are absent.

Esler remarks: (5) "The six abundant grasses (Danthonia, Microlaena, Indian doab, carpet grass, buffalo grass and ratstail) have seed heads which are unattractive to wallabies or: the grasses can spread without producing heads," Esler continues: "It seems likely that wallabies are holding in check such plants as wooly nightshade, apple of Sodom, and purple flowered pampus. A wide ranging species such as Coprosma is not found in appropriate areas." He further notes that the ferns, Asplenium lucidium in particular, survives well in spite of browsing damage.

Esler (5) recognised that in this area existed "one of the oddest mixtures of plants to be found anywhere in New Zealand.....brought about by the mass escape of horticultural plants and the sorting of the whole flora by wallabies."

The following is a description on the botany of Mansion House Bay by John Buchanan, F.L.S. (II) – part of a paper presented to the Wellington Philosophical Society, September 2, 1876. (Buchanan was a botanist and draughtsman to the geological Society of New Zealand).
The line of Canary Island Palms on the left and the Holm Oak on the right entrance the Eastern side of Mansion House. The main entrance is in the centre of the picture.
"On the lawn may be seen Erythrina caffra, the coral tree, covered with brilliant scarlet flowers; Fourcroyia gigantea, a plant of the Amaryllis family, with remarkable flowers.

Fourcroyia flavavirides, another fine fibre plant; Chamaerops excelsa a palm tree also producing a fine fibre, and Chaemaerops fortunii, Bocmeria nivea, another fine fibre tree belonging to the nettle family, Musa textilis, the Banana fibre tree from which the manilla fibre of commerce is procured; as also Musa sapientum, the fruit Banana, which yearly ripens fruit here; Brousonetia papyrifera, from which a kind of paper is made in Japan; Punica granatum, the pomegranate; Olea europaea, the Olive, all the finest varieties of this valuable species are cultivated here.

Arduina grandiflora, the Natal Plum, worthy of cultivation for its fruit; Flcus carica, the Fig Tree, and several other species of this family; Anona muricata, the Custard Apple; Ceratonia siliqua, St John's Bread tree; Eriobotrya japonica, the Loquat tree, which bears abundantly; Zingiber officinalis, Ginger, several species of this family; Stilligia seifera, the Tallow tree from which the Japanese manufacture candles.

Quercus suber, the Cork tree, is represented by several large specimens. Several curious species of Japanese oaks; groves of Aralia papyrifera, the Paper tree; Xanthorea hastillis, the curious Grass-tree of Australia; numerous species of Bamboos, including the gigantic Bamboo.

When to this list are added Cinnamon, Camphor, Orange, Lemon and Citron trees, sufficient proof is given of the existence of a remarkably mild climate."

It seems clear that the presence of Victoriana single specimen planting dominates still the character of the Bay, reflecting the ecological radicalism of Sir George Grey.

To preserve this history, the identity of the Bay area must be positively established as unique from the rest of the site, both as an architectural and planting statement.
It has been mentioned during the course of this study the impact of wallabies and fire have had on the vegetative pattern. If present conditions continue, Esler (5) makes the following predictions: "Remaining pasture will disappear in the next decade (about 40 acres has been lost since 1960). Scrub and pine forest is the inevitable cover of the whole domain outside the Mansion House grounds, but unless there is fire or soil disturbance pines will not maintain themselves indefinitely. Evidence of this exists on Momona Point where exotic trees and shrubs will take the place of pines as they die. This area can be taken as an illustration of the fate of much of the vegetation of Mansion House Bay.

Prediction of the changes is illustrated below.

Wallabies: The summary for southern Kawau (as previously shown) displays the percentage - distribution of the Parma, eugenii, and Bicolour wallaby.

Distribution is centred around Mansion House Bay where visitors feed the marsupials. They are nocturnal and at dusk present a feature of interest.
Residency is confined to the northern Bays of Bon Accord Harbour, encouraged by protected waters and safe anchorages.

The following illustrate the residential pattern:

**Mansion House Bay:** commercial facilities provide for motel accommodation; casual camping, including picnic areas; shops; Post Office; and a liquor license within the Hotel complex.

**Two House Bay:** private residential; the H.G.M.P. ranger lives here.

**Shark Bay:** temporary and permanent private residents.

**School House Bay:** private and commercial, including a fishing village. This bay and the associated area is likely to direct pressure on the Park-land for an urban character is being created through the subdividing of land. There is need therefore, for the protection of vegetation along the road fringe from fire etc., as well as ensuring attention is given to the visual qualities of the vegetation as viewed from the road.

**Harris Bay:** private residential.
John Morton (11) reports strictly horizontal zones of animals and plants exist on the shelving inter-tidal platforms around the study area. These zones cut clearly across the dark greywacke rock face.

A pohutukawa fringe generally overhangs from coastal bush above, with associated Coprosma repens (Taupata) expected on the rock face.

At the platform level the rock is bare, or with only stubby black lichens (lichina) and many small pools. Two high tidal snails live here on lichens and blue green algae films: Melarapha olivert and the larger Menta melanotragus.

Below this ledge, the shore falls away steeply to become grey-brown with a zone of barnacles: Chamaesipho columna (through sparse on mudstones)

Rock oysters (Crassostrea glomerata) appear in the next below zone, except where the shore is more wave exposed - in this case the larger ridged surf barnacle Elminus plicatus forms a zone of its own.

Beyond here the Algae begin with a broad carpet of grey to mauve Corrallina officinalis turf, the white tube worm Pomatoceros caeruleus sometimes mingled with the turf.

Both in the harbours and on the moderately open shores, this may be accompanied by the bladdered tresses of the Venus' necklace, Hormosira banksii.

At the low tidal fringe, or sub littoral fringe, is found the small kelp Ecklonia radiata.

Just visible at low tide appear the tresses of large brown algae, - the flap jack : Carpophyllam

Clearly then, the marine habitats supported around the study area are both sensitive and complex - and vital to their existence is a strong concern for management of the resource.

Any pollution discharged into their unique environment has an effect detrimental to their existence, For the recreators in the study area the inter-tidal platforms provides for educational and scientific opportunity.
Therefore, the platforms require special management attention for two reasons:

1. their environmental sensitivity
2. A resource potential.
Protected Sandy Bay (in close proximity to the Mansion House complex) is situated along the Coastal Corridor. Slump and creep erosive processes are evident in places, due to the inability of the pine to root deeply, and hold the soil mass.
The visual character is largely determined by the presence of introduced exotics. Their pyramidal form and vertical scale contrast with the rounded umbrella shape of the coastal pohutukawa, and the smaller scale kanuka and manuka scrubland.

As a seascape, the study area appears as land almost totally carpeted in Pine. (See perspective view).

Open unvegetated areas are few and where they occur, commonly there exists the Pine backdrop. However, within the apparent sameness, or identity of south western Kawau, areas do register as being different to one another, either in visual or physical terms.

Identity areas then, are those whose elements possess a uniqueness. And, because it is assessed qualitatively, it is perceptually construed as being a certain character or quality - identity areas are "read" from the landscape.

Given that man is a perceptual animal within his response evoking environment, (the landscape) and that the level of his understanding (reading) the landscape is determined through his past learning experiences and his intuitiveness, it is my contention that the reality confronting man as a landscape involves three main levels:

1. Visual patterns, dictated by the interaction of historical geology and man.

2. Appreciation of the forms, colours, spaces that interact through the patterns....

3. The Ephemeral associations, such as scented flowers, rustling wind etc.

Reading the order, and identifying the many interrelated parts that go to make up the total system, is illustrated in the Site qualities map.
On approaching the study area, the Pine backdrop determines the visual character. Momana Point (in the foreground) is covered in Pine down to the cliff edges, maintaining a slim hold on the underlying soil bodies. Mansion House is visible to the left of the picture.
IDENTITY AREA 1: MANSION HOUSE BAY

-focal point of the study area. Within the foreshore of the Bay are sited Mansion House and accommodation and associated service buildings.

Their "architectural statement" upon the landscape is to produce a visual clutter through indiscriminate siting, and neglect to circulation between buildings and spaces.

The aim should be to combine utility with good design (attention to detail) thereby creating ease of circulation and a visually stimulating environment: attention to places, spaces, and linkages between them, ensures a well co-ordinated site. Beyond the buildings a pond colonised by Cabbage tree and Palms divides the space, and signals the change in land use, from accommodation to open land for recreation.

Mature Pines define the Minaxity of the Bay and reinforce the visual enclosure. Those Pines growing along the adjacent ridge lines are particularly important in preserving this feature.

2. COASTAL CORRIDOR:

This identity area extends from Farmers Bay to the old coppermine, and includes those areas up to the ridge line. A sequence of travel is experienced along steeply cliffed walks, with many viewing points that offer a variety of views, both along the study coastline and out to sea. Protected sandy bays with associated open areas, and tidal platforms exposed at low tide are a feature of this coastline, dominated by cliff hugging pohutukawa and native vegetation in the gulleys.

The old copper mine building and disused mine shaft is reached by a short walk over a boulder strewn part of the Bay.

3. THE OXIDATION PONDS:

An enclosed basin shaped area, defined by a perimeter of Pine with a generous understory of fern.

Adjacent to the Coastal corridor, the ponds are presented to the visitor quite suddenly. Their naked presence deny the natural enhancement of the area as a fernery, with associated areas for passive recreation.
From Coppermine Point (looking north to Dispute Cove) a grove of pohutukawa lines the foreshore, with the Pine forming the skyline beyond.
At Ladys Bay,
The old Coppermine and Shaft is enframed by the distinctive form of the coast loving pohutukawa.
This photograph shows more clearly the fern understory, particularly at the perimeter of the pine stand.

Note the timber lying on the ground amidst the overstocked stand.
The lighter stem densities of the Pine in this area allows "lines of vision" across the basin and beyond.

4. PICNIC AREA:
The Coach Road firmly zones this area of gently undulating land defined by young pines. Existing use is as an informal picnic area.

A line of Kanuka acts as a buffer from the road, producing a contrast in textural and scale relationships, as against the verticality of the pines. The result is one of enclosed intimacy, that is enhanced through a sequence of excellent views presented of the coppermine and the mainland in the distance. Linkage to Dispute Cove is provided by a track that passes through manuka/kanuka, wet gulley vegetation and coastal pohutukawa.

5. REDWOOD TRACK:
This gulley system is defined by the ridges, that extend approximately 80m. on either side. Access is by a walking track from Mansion House Bay, passing by "Sire George Grey lookout" situated on the small promontory between the two Bays. A profusion of Wattles have colonised the point, resulting in slope instability and visual detraction. The track is prone to slump and mass movement of the soil surface - a consequence of the inability of the Pines to "hold" the slope.

Two House Bay presents an enclosed Bay frontage adjacent to a canopy of manuka and smaller fern, that signals the existence of the small stream characterising the gulley.

The avenue of tall, overhanging fern on the track sides which follow the stream, imparts a sense of human scale similar to that experienced in the vaulted rooves of small churches. (The photograph on the introduction to this report typifies the enclosure).

Mature Redwoods (Sequoia dendron) meet the visitor further on up the gulley, interspersed with the occasional Oak tree, illustrating the horticultural escapes typical of Mansion House Bay - the deciduous Oak seems a bizarre
Dispute Cove and along to Coppermine Point signal the change in vegetation: from predominantly exotic to the rounded umbrella shape of the pohutukawa, with the manuka scrub beyond. In the background, South Cove presents a ridge-line of young pine - soon to be replaced in places by a skyline of dwellings.
element in the conifer and fern forest.

An open enclosed area, flanked by a perimeter of Pine is found where the track meets the Coach Road. This area could provide the linkage into the Coastal corridor.
Identity Areas 7 and 8

Grazed up to a few years ago, this area has now regenerated in Manuka (Kanuka between 2 - 3 metres in height.)

Thus, the pattern of vegetation defines the area. Characteristic vegetation of ferns etc., appear in the gulleys (area 8). The photograph on page shows the open space once existing on these steep slopes.

On the coastal margins, pohutakawa cling above the boulder strewn shores that in the cove reveal the wide tidal mud flats.

A small sandy bay is a feature of this area amidst groupings of pohutukawa - and from this point a good view is presented of the copper mine and beyond.

Potential also exists for wide sweeping coastal views from the ridges above, as evidenced from the isolated views between breaks in the Kanuka.

Identity Area 9.

This promontory is vegetated largely in pohutukawa and associated coastal species, interspersed with clumps of Fine.

A visual corridor along the top of the ridge (defined by trees and scrub on either side) leads to the promontory point, where there are views across the bay and up harbour.

The private land signals the beginning of isolated residential holdings that appear around the perimeter of Bon Accord Harbour.
Identity Area 10 and 11.

Both areas 10 and 11, well vegetated in Pine are dotted with private sections of land around the coastal margins. Proposed plans for further subdivisions within these areas will contribute an "urban-flavour" adjacent to the road boundary. Amenity standards are needed therefore, to ensure visual enhancement, and to control any visual detractor. In addition, fire breaks are necessary along the northern and southern side of the road, where residential development is taking place. These breaks should also be controlled through standards of amenity.

Identity Area 12, 13 and 14.

A track following the water course travels area 12, and links Sir George Grey Coach Road to School House Road. In winter, the track is virtually unusable, because of undercutting and flooding of the overtaxed stream - water collects in a pond as a catchment for the gulley above. Fern and manuka/kanuka line either side of the track where the ground is stable.

An historic cemetery enclosed by tall manuka adds a sense of atmosphere to identity area 13 (see following photograph). In contrast, indiscriminate dumping of Mansion House Bay rubbish to "fill in" a small depression of land, adds an atmosphere of its own - one established through poor planning and an attitude of "hide it and forget it". Rusty tins and broken bottles are a feature of this area.

The environmental negligence evident in this "disposal system" has resolved the short term problem: that of removing rubbish, but fails to respect "appropriate" policies of compacting or recycling that would appear cognizant with a general policy for a small Island eco-system.

The effect has been to destroy an ecologically stable area: to render useless potential for recreation and to constitute a severe visual distraction for the area.

In addition, Identity 13 includes:

1. an old logging sawmill - part of the residential cluster enclosed by the shallow mouth of School House Bay.
Here, the commercial fishing lodge and grouped buildings along the foreshore speak of the urban style encroachment expected on the boundaries of the study area.

2. Catchment area and pond for Mansion House Bay water supply - an area endowed with a rich covering of fern and scrub.

Manuka and a few scattered Pine at Harris Bay define area 14, separated from School House Bay by a long shallow estuary.
It is recognised (13) that in shoreline areas, there are two types of planning: planning for the resource base of the environmental aspect; and planning for man made facilities, or the development aspect.

Planning for land use then, must be in accordance with the capability of that land, and water, to support various uses - and prohibiting non-compatible uses in or adjacent to these areas.

The following land use compatibility matrix attempts to define the above for the study area, by grouping together compatible activities, and separating those that are incompatible.

The matrix (supported by the site qualities map) provides "in sight" into the formulation of policy (the concept) and in guiding the development of the Master Plan.

It is revealed that rubbish removal, sewage disposal, and forestry removal are incompatible with all other activities in the matrix - and to a lesser extent those incompatible are: water supply, natural watershed and maintenance. These constitute the planning contraints.

The study area offers features of both historical and natural interest (as shown) in close proximity with the coastal experiences. Utilization of the resource, therefore, should be consistent with the concept of providing recreation with the opportunity to enjoy these features, yet ensuring the protection of the environment systems. Recreation should be aimed at casual participation - through activities that are essentially "natural" in character; such as swimming, boating, fishing, diving, walking, nature study, etc.

Two dominant land uses compete for user privelage in the study area: these are recreation and forestry.
## Land Use Compatibility

<table>
<thead>
<tr>
<th>Angle of Slope</th>
<th>Recreation</th>
<th>Wildlife Ecosystems</th>
<th>Natural Systems</th>
<th>Forestry</th>
<th>Residency</th>
</tr>
</thead>
<tbody>
<tr>
<td>20° - 33°</td>
<td>NATURE BAY</td>
<td>SHORELINE</td>
<td>MARINE</td>
<td>MAINTENANCE</td>
<td>WASTE SUPPLY</td>
</tr>
<tr>
<td>0° - 10°</td>
<td>WASTE BAY</td>
<td>BUSH</td>
<td>WILDLIFE</td>
<td>MAINTENANCE</td>
<td>TREATMENT</td>
</tr>
<tr>
<td>&gt; 33°</td>
<td>CAMPING</td>
<td>FOREST</td>
<td>BAY</td>
<td>MAINTENANCE</td>
<td>TRASH DISPO</td>
</tr>
</tbody>
</table>
1. RECREATION:
The main recreational corridor (as shown) offers a variety of recreational opportunities and coastal experiences, which satisfy the natural activities as discussed above.

Use "linkages", or pathways between various activities, ensures that site circulation would make the best of site features - and provide a sequence of travel from Mansion House Bay, through the recreational corridor, along the Coach Road and down to the Redwood track. Along its path, the recreational corridor features cliff top viewing; small enclosed bays; opportunity for nature study at the inter-tidal platforms; a long open area on the ridge for picnicing; boulder strewn coast; and the historical coppermine and shaft.

It is envisaged then, that the recreational corridor will experience "peak use" over the study area. Dispersed interests, such as the old cemetery, Island walks etc., will determine other recreational pursuits.

2. FORESTRY:
Unlike some forested areas in New Zealand, the total yield criteria has never been the objective in the establishment of Pine stands on Kawau. However, recent interest by the New Zealand Forest Service has suggested a management plan for the exotic plantation, (14) and sees its objectives as managing and protecting the forest, (with a minimum of cutting required). In accordance with the recreational demands on the area, the Forest Service considers that except for natural hazards such as wind throw or disease, the Pines should stand for a further 50 years.

Management involves:

1. leaving the Coastal margins (recreational corridor) to evolve a natural forest cover of exotic and native species, and minimising public access to these areas.

2. thinning the denser Pine stands along the ridges in the centre of the peninsula, (300-350 s.p.h.a.) and removing dead and dying trees which exist as a
fire hazard. Fire hazard will be controlled through 100% pruning of the track sides, two metres up the stem, and all needles, branches and debris (and scrub where present) will be removed back for 5 metres either side of the track.

The Forest Service considers that where breaks in the forest canopy occur, enrichment planting with species shown to be less palatable to the wallabies should complement, and eventually replace the present Pine forest cover. This is the Forest Service Amenity Plan - arrived at through chance breaks in the forest canopy.

Although satisfying management, this policy does not consider the forest as a visual amenity: one in which the forest provides for visual variety with degrees of visual penetration through the stand, giving a sequence of views determined by topography; natural viewing stations; and recreational and natural systems suitability. Nor does this policy consider the appropriateness of open space systems as logicalized by the circulation pattern.

Therefore, a landscape policy for forestry removal in the Study Area should be concerned with both management of the existing stand, and the realization of the recreational and environmental objectives.

A suggested policy for thinning and removal is given below.

1. Coastal margins along recreational corridor - thin and remove Pine and encourage natural regeneration, thereby controlling slump and creep of hill slopes.

2. Ridges - retain Pine on ridges, maintaining soil stability and preserving the planting theme through the site.

3. Gulley - thin up to the ridge line allowing light through the remaining canopy. Establish a forest understory that would extend from the native
species in the gulley floor. (This is considered particularly important for the Catchment area).

4. Remove Pine where open space is indicated on the concept map.

LOGGING

Landscape controls are necessary to protect the recreational and environmental resource during the removal and transportation of logs to the saw mill site (as shown). Provided stock-piling areas are cleared, (at locations to be decided on closer inspection of the study area), School House Bay Road would be suitable as a general logging road. These areas should be visually separated from the road through using existing "buffer" planting as a screen.

In summary, it is considered that the pattern of vegetative coverage will in most part be directed through satisfying the recreational objectives - maximising site opportunity in accordance with the environmental systems.
This section deals with a detailed study of Mansion House Bay, and is concerned with:
- the users of the Bay
- the demands made upon the area
- design concept.

Kevin Lynch considers that:

"understanding how people use and value the spatial environment is the key to planning sites that fit human purposes...and that some analysis of the requirements of those who will experience the environment is essential.....to get inside the environmental experience." (15)

The following list gives the 'requirements' of those who will use Mansion House Bay:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>NEEDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service staff</td>
<td>enclo - privacy with associated informal use area.</td>
</tr>
<tr>
<td>Public ferry and float plane</td>
<td>Day visit and overnight accommodation. (The ferry day visit is from 10 a.m. - 3 p.m.). A need for interpretation and shop facilities; &quot;day room&quot;; public picnic area; and adjacent informal recreation area with associated water area.</td>
</tr>
<tr>
<td>Private crafts -</td>
<td>1-2 day mooring - safe anchorage; interpretation facilities; service requirements (fuel, food, water, etc.)</td>
</tr>
<tr>
<td>(1) Keeler class</td>
<td>Interpretation, service requirements; associated beach area.</td>
</tr>
<tr>
<td>(2) Cabin cruiser</td>
<td></td>
</tr>
</tbody>
</table>
Part of the Mansion House complex showing the pool in the foreground; the pub on the right; and the Mansion House and shop facilities on the left.
Mansion House Bay as seen from Sir George Grey lookout ...
where Pines and Wattles are established on the point.
So, the user needs and their demands made upon the area (in physical, and environmental terms) will enable the designer to "get inside" the Mansion House Bay experience, providing planning data to them direct the design concept.

Mansion House Bay may be thought of as a large area/space containing many smaller spaces, defined through the user demand and activity within the spaces. Linking the spaces then, are the movement systems (pathways, road, etc.) directing and controlling movement of the site users.

Movement systems may also be considered as "desire lines", or, as communication pathways. Because people are directed along certain routes then, hard surfacing is necessary to withstand high user pressure on this comparatively small area. Thus, movement systems further constitute "patterns on the ground".

The main physical demand upon the area to be considered, is logicalizing the patterns on the ground, with respect to the user needs. To a lesser extent other considerations are:

1. service areas - for storing machinery; utility sheds etc.
2. service reticulation - power, water, drainage, sewage etc.
3. accommodation areas for staff; and single, double and family units.
4. informal areas - picnicing etc.
5. formal public areas - courtyards, seating places, etc.
6. visitor interpretation centre - park information etc.
7. Shops.
8. refueling facilities associated with the wharf.
Environmental demands include:

1. planting selection - a concern for plant form and plant suitability
2. pollutant control - the necessity to encourage waste disposal in accord with the natural systems
3. A concern for building mass, where the scale and juxtaposition of building to building is in sympathy with the immediate environment.

ARE\A SURVEY

Spaces - At present the spaces existing around the vegetation and buildings are random and arbitrary - with little sense of linkage between activities or rationality to associated use. The confinement evident upon walking from the wharf to the pub, disperses upon passing the pub, to a confused clutter of weakly defined areas - particularly in the semi-enclosure created through the placement of the pub; the accommodation units; and the road.

Consequently, the position of the pool has no sense of purpose - it appears as an afterthought, added to fill up this awkward space.

The removal of an old Edwardian bungalow in August 1975 (sited north-south, approximately behind the Moreton Bay Fig) created a naked space which contributes to the lack of privacy for the visitors staying in the adjacent accommodation units.

Behind Mansion House, service space reflects the haphazard placement of building to building - with no firm division between the service area and the accommodation area.

In contrast, the foreshore development along the sea wall provides intimate areas to experience views up Bon Accord Harbour.

2. Places: - Visual congruency has been discussed in the area survey, reflecting the relationship of building type to building type, using as a
criteria, "design flow": or, harmony of the structural elements between the different buildings. (design determinants of scale and mass are important here).

The siting of the buildings displays the somewhat haphazard approach towards the development of the Bay, where the building masses have been considered, not as a total statement on the ground, (as a visual gestalt) but instead, as individual elements.

In addition, the service buildings have been sited in close proximity with an accommodation complex, and, adjacent to the primary circulation route - it is desirable then, to separate conflicting uses within the Bay.

However, the existing concept of siting the staff accommodation and other small buildings close to the side of the Bay is successful, for their mass is easily absorbed through the increased scale relationship of the trees and rising land form, behind the buildings.

3. Linkages: The primary circulation route of the Sir George Grey Coach Road bisects the Bay, and offers potential for the creation of a "village scape", through accentuating the narrow road corridor by the close groupings of plants and buildings: - thereby creating a sequence of closed and open spaces.

Leading off this main road however, "finger" circulation routes to the various buildings, are only weakly defined, and again appear arbitrary in their placement. An exception to this is the path along the foreshore passing the Canary Island Palms in front of the pub - here there is a logical relationship between the sea wall, the Palms, and the buildings.

Concept

Mansion House, the pub, and the two existing accommodation units (as shown) have been accepted as the design contraints. The area Survey shows the appearance of the units as 3a, (incongruent but structurally sound) and 1a (visually congruent and structurally sound). Therefore, re-development of the Bay accepts the siting of these buildings, and attempts to integrate their placement with the new design proposals.
The concept envisaged, is to create a village atmosphere on either side of the main circulation spine, through the creation of a linear and small scale avenue, with a sequence of defined spaces provided along its route.

The existing accommodation units on the western side of the Bay signal the end of this linear corridor - therefore at this point, a change in space is experienced, from linear confinement to openness.

A courtyard is created immediately behind the Mansion House, (an area approximately twice the length of Mansion House) allowing the Mansion House to exist uncluttered by encroaching buildings. Adjacent to the courtyard, a visitor interpretation centre and shops etc, is proposed, with an open verandah overlooking the avenue. A public information centre is provided to the south of this complex, separated from the accommodation units by low hedging.

Staff accommodation is clustered against the western side of the Bay, where planting encourages a sense of enclosure to the area.

On the eastern side of the Bay clustered accommodation featuring single (250-300 sq.ft; (or 28 sq. metres) and double 350 sq.ft; (or 32.5 sq. metres) units surround a private courtyard.

It is envisaged that this accommodation cluster be dropped in level, 300 mm below the existing ground level; to reinforce the enclosure.

A pool and outside cooking facilities are sited adjacent to the complex, and a service area for clothes drying; childrens play etc. is provided (as shown). Sited away from the central accommodation complex are family units (400 sq.ft; or 36.2 sq. metres) with access provided through the new planting.

It is proposed that the raised concrete patio, covered by green plastic sheeting, be removed from in front of the pub. A wooden verandah would be more appropriate, and architecturally more congruent with the Mansion House opposite. In addition, if access to the pub was provided through the East Wall, potential would exist for the creation of a garden bar area.
Although out of the scope of this study, it is recommended that a separate wharf is provided for servicing requirements. This would remove the present conflict between commercial and recreational interest. Possible sites exist on the small promontory between Mansion House Bay and School House Bay, with wharf access provided by the existing minor road on the eastern side of the Bay.

The maintenance area for the Bay has been sited adjacent to this minor road, so that: there is no longer a need for a road to run across the Bay; maintenance activities are removed from the Bay centre and the proposed avenue.
RENEWABLE ENERGY:

In an age of increasing environmental concern, non pollutant and renewable forms of energy seem consistent with the basic aims of the H.C.M.P., see sections 3.1 of this study).

The following discusses briefly, two small scale energy systems suitable for the Mansion House Bay complex.

1. Heliothermal Energy: Heliothermal devices absorb solar radiation on blackened surfaces and convert it to heat. The black surfaces will attain a temperature at which equilibrium is established between the rate at which energy is being absorbed, and the rate at which energy is being lost to the surrounding atmosphere.

The actual heating of water and air by solar radiation is one of the most valuable applications of heliothermal technology, (see Appendix VIII for details) Its application for Mansion House Bay (with the Islands high temperature readings) would enable much of the complex to be self sufficient in energy consumption demanded for the heating of water and air. The system may also be modified to heat the swimming pool, and, generally speaking, the solar panels required are half that of the area of the pool.

2. Wind Energy:

A modern wind driven generator extracts energy from the wind and converts it to electricity. In the Mansion House Bay, it could be used as an energy supplement, in conjunction with the existing underground mains supply.

The most economical windmill is one which furnishes the kilowatt-hr at the lowest cost, (see Appendix VIII b.) - although production is made difficult by the fact that the wind is an intermittent source of energy. However, the actual power available from the wind is proportional to the cube of the wind-speed, i.e.: if the windspeed is doubled, you will get eight times as much power. Another fundamental principle governing windmill design is that it is theoretically impossible in an open air windplant to recover more than
59.26% of the kinetic energy contained in the wind. And, the amount of energy captured depends on the amount of wind intercepted, i.e., the disc area swept by the blades.

Therefore, the design is commonly restricted to wind velocity of 3 to 10 metres per second (6.7 to 23.3 m.p.h.)

To determine the usable output (kw - hrs. per month) produced by a particular size wind driven system, the output characteristics of the wind plant and the average yearly wind speed at the site must be known. Therefore, accurate wind data is necessary at Mansion House Bay to determine the feasibility of a wind driven generator scheme. In the interim, a small hand held anemometer would yield estimates of local wind conditions.
Conclusion

Since the formation of its Geological layer 50m years ago, the study area has responded to particular environmental changes.

From age to age, successive layers have ensured the establishment of soil and vegetation providing habitat for different life systems.

The cultural layer began only 200 - 300 years ago: the significant period from 1842 onwards, following interest in copper and manganese deposits on the Island.

The residency of Sir George Grey established the "recreational pattern" on the study area - a theme that is continued today by the Hauraki Gulf Maritime Parks Board.

Figures from recreational studies in the Auckland and Hauraki Gulf region show a trend of increasing user pressure for the inner Islands of the Gulf and the associated coastal areas. Acquisition of the study area in 1967 as part of the Hauraki Gulf Maritime Park complex makes available this area to a recreational maritime public.

Development of the study area has been consistent with maximising site opportunity for the visiting public yet ensuring protection of the environmental and visual resources.

Management controls involve encouragement of native vegetation and a thinning and removal programme for areas of existing Pine cover. Milling the Pine on site is suggested, with landscape controls on the stock-piling of logs.

The focus of the study at Mansion House Bay has been considered in more detail: here, concern has been to integrate development in accord with the projected users of the bay, and their needs. The concept envisaged is the creation of a village atmosphere at the fore front of the Bay.
The data covered in this report has attempted to realise the two fold objectives of the study:

1. to satisfy the user requirements of the study area and manage the site's capability to absorb use
2. to direct any change in accord and in sympathy with the natural systems existing in the area.

In overview, perhaps a third objective might be stated for the study: that the historical character of the Bay be preserved in all new development.

It is hoped that this project may have some practical value beyond that of satisfying a student brief.
(i) - to Mr. Harris, gardener.  
- Taranaki May 7, 1863.

"I want the top of the hill behind your house fenced for the pine - thus the new fence runs over the hill from the barn between your garden and the sea to near the shepherds house, then along the side of the hill in the valley where the shepherds house stands - until it meets the road again... through the scrub... thus straight back to the present fence... to the top of the hill behind your house wherever there is fair land. Then, to dig up and planted with pines in clumps, half the Norfolk Island for this purpose, half other pines...

(ii) Taranaki, April 14, 1862

"In 2 or 3 weeks 25 bushels of selected grass seed will arrive from England - the land near the house and up the hill has not to be sown, - I would leave that until this good seed arrives. The Cocks Foot grass seed should be sown thick, I would sow it on the roads, over the clayland and not near the house.

(iii) From Capt. Charles Webley Hope (1867)

"I have just returned here from a trip to the Fiji Islands where I got some plants for you of different kinds. Amongst them are BIRDSCYE CHILLI, - strong and healthy but will require shelter in winter. Also, some plants of a curious palm, something like a Cocoa plant but with a spike rising up the centre...."

(iv) From Thomas Kirk, 21 May 1888, (asking Sir George to supply botanical specimens)

"It grew as you remember near the top of the hill in company with Pittosporum tenuifolium which it closely resembles in foliage but is however somewhat larger, the capsules are always on the tip of the branches, - those of P. tenuifolium are in the axils of the leaves P. crassifolium which grows on the cliffs,... is likely to prove an addition to our list of native plants, - it is the Helascadium leptophyllum.

(v) From Thomas Kirk, June 2, 1887.

"I have just returned from a trip to the East Coast which I had the good fortune to discover the fine -Greyii named after you... which has not been collected since Colenso originally discovered it nearly 40 years ago....

(vi) From Wills, writer of verse for the Auckland Star, April 16, 1885

"I have written a poem on "Fair Kawau Island" - but my friends tell me, it would be better to wait a little time before I print it - they say that there is too much "poetry" in it, and I must cool it down a little."
APPENDIX II

The recreational studies are based on five surveys of metropolitan areas in Auckland, and attempts to identify the recreational patterns.

The study consisted of 3 sections:

1. Personal questionnaire, which sought to establish the age group, sex, and present recreation activities desired.

2. Second questionnaire, completed by club officials etc., to survey the variety and uses of the various recreational programmes and facilities existing in that area.

3. Conclusions - regarding the needs of the area in terms of programmes, and facilities.

The age and sex breakdown shows that males, particularly those in the 26-45 group, are the biggest participants in these sports at present, although high "Would like to do" returns have been received from boys in the 7-18 year age range.

The results point to the need for greater recreational use of Auckland's maritime situation.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Male Do Now</th>
<th>Female Do Now</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-13</td>
<td>154 43.5%</td>
<td>91 25.0%</td>
<td>245 34.0%</td>
</tr>
<tr>
<td>14-18</td>
<td>75 40.0%</td>
<td>60 30.0%</td>
<td>135 34.5%</td>
</tr>
<tr>
<td>19-25</td>
<td>81 47.0%</td>
<td>51 22.5%</td>
<td>132 33.0%</td>
</tr>
<tr>
<td>26-45</td>
<td>242 49.0%</td>
<td>119 22.5%</td>
<td>361 35.5%</td>
</tr>
<tr>
<td>46-60</td>
<td>52 32.5%</td>
<td>27 15.0%</td>
<td>79 23.5%</td>
</tr>
<tr>
<td>60+</td>
<td>6 16.0%</td>
<td>1 2.5%</td>
<td>7 9.5%</td>
</tr>
<tr>
<td>TOTALS:</td>
<td>610 43.5%</td>
<td>348 22.5%</td>
<td>959 32.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Male Would Like to Do</th>
<th>Female Would Like to Do</th>
<th>Total Would Like to Do</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-13</td>
<td>355 100.0%</td>
<td>273 74.5%</td>
<td>628 87.0%</td>
</tr>
<tr>
<td>14-18</td>
<td>149 79.5%</td>
<td>135 66.0%</td>
<td>284 72.5%</td>
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<td>19-25</td>
<td>66 38.5%</td>
<td>103 45.0%</td>
<td>169 42.0%</td>
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<td>134 25.5%</td>
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<td>46-60</td>
<td>45 28.0%</td>
<td>17 10.0%</td>
<td>62 18.5%</td>
</tr>
<tr>
<td>60+</td>
<td>8 21.0%</td>
<td>2 24.5%</td>
<td>10 22.5%</td>
</tr>
<tr>
<td>TOTALS:</td>
<td>918 65.5%</td>
<td>671 43.5%</td>
<td>1589 54.0%</td>
</tr>
</tbody>
</table>
Coastal resource capability has been determined by considering the range of possible recreational uses appropriate to a stretch of coast by virtue of its physical, scientific and visual characteristics.
### APPENDIX IV

**COURTESY NEW ZEALAND MET SERVICE** (Figs rounded to nearest whole number)

#### A.

<table>
<thead>
<tr>
<th>J</th>
<th>F</th>
<th>M</th>
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<th>D</th>
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<tbody>
<tr>
<td>RAINFALL M.M. - ESTIMATED FROM SHORT RECORD</td>
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**Station: A66001 Kairau Island Lat. 36. 26S Long. 174. 49E. Ht:12m.**
APPENDIX V


DETAILS OF THE GEOLOGICAL STRUCTURE

The Sandstones: - of varying thickness with grain size increasing up to a 5 cm top. Generally the bedding is massive, and only where they merge into the argillites (unified mudstones) and/or siltstones can sedimentary structures be seen.

In some thin sections minor chips of argillite are seen to occur in sandstones along with spelite fragments.

The sandstones consist of angular subbounded chips of feldspar, quartz rock fragments (the main components. There is also growth of secondary quartz chlorite, selicitate, tenonere, pynite, and possibly manguetite, brotite and fero-magnesium minerals.
**APPENDIX VI**

Extracted from the District Planning Scheme Review for Rodney County (1975)

**KAWAU ISLAND**

**Objective**

To encourage the development of the island for resort purposes in such a way as will ensure the special qualities and character of the area are retained.

**Policies**

(i) The reduction in area within which residential or resort development can occur. Further expansion will only be permitted when a need, based on residential use not sections created, can be established.

(ii) The designation of areas suitable for public/reserve along the coastline.

(iii) The designation of a substantial area for reserve purposes in the vicinity of Bostequet Bay.

(iv) Because of drainage difficulties and the impracticality of providing a public sewage disposal system, minimum lot sizes be approximately 4000m².

(v) The recognition of sea access as the principal means of property access and the discouragement of motor vehicles on the island. Any public roads will thus be formed to such a standard as will inhibit the use of motor vehicles.

(vi) Because of the unique climate of the island encouragement will be given to the commercial growing of sub-tropical specialist crops.

(vii) The development of a system of walkways to enable the public to have a greater appreciation of the island, yet ensure adequate privacy for property owners.

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**APPENDIX VII**

From the Water and Soil Conservation Act 1967

**SIXTH SCHEDULE** Standards for Class SB Waters

The quality of Class SB waters shall conform to the following requirements:

(a) The natural water temperature shall not be changed by more than 3 degrees Celsius.

(b) The natural pH of the waters shall not be changed by more than 0.1 unit and at no time shall be less than 6.7 or greater than 8.5:

(c) There shall be no destruction of natural aquatic life by reason of a concentration of toxic substances nor shall the waters emit objectionable odours:

(d) The natural colour and clarity of the waters shall not be changed to a conspicuous extent:

(e) The dissolved oxygen content in solution in the waters shall not be reduced below 5 milligrams per litre:

(f) Based on not fewer than 5 samples taken over not more than a 30-day period, the median value of the faecal coliform bacteria content of the waters shall not exceed 200 per 100 millilitres.

(g) Repealed by s.30 (e) of the Water and Soil Conservation Amendment Act 1973.
APPENDIX VIII

SHOWING SOLAR AND WIND ENERGY SYSTEMS

**a**

![Typical Flat-Plate Solar Collector](image)

- Glass
- Casing
- Inlet
- Outlet
- Air Space
- Flat Collector Plate
- Water Pipe
- Insulation

**b**

![Wind-driven Generator System](image)

In this system, the wind-driven generator charges a battery bank, from which DC power is taken directly for use or inverted, making AC for appliances like TV, and radios. Excess power runs a heating storage system.
## References


7. FAIRBROTHER, N. "New Lives, New Landscapes".


Charlie Challenger - Reader in landscape Architecture, Lincoln College.

Mike Cole - Lecturer in landscape Architecture, Lincoln College.

The Planning staff at the lands & survey Dept. Auckland for the help and assistance.

Ted Cox - Soil Bureau, D.S.I.R., Mt. Albert Research Centre, Auckland.


Allan Wood - 2nd year M.S.c Geology student, Auckland University.

Professor John Morton - Zoology Dept, Auckland University.

Jo Brittenden - For her typing assistance.